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Observations on Mountain plover (*Charadrius montanus*) Breeding in Utah

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appeared to at least one experienced field worker (L. J. Vitt, pers. comm., cited in Cooper et al., 1985), that *C. variegatus* only shared shelters randomly. Cooper et al. (1985) performed laboratory tests in which they found that *C. variegatus* aggregated. However, this finding had not been replicated in the field.

Geckos for my analysis were collected at various dump sites throughout Maricopa County, Arizona, 18–31 March 1992. This was probably before their breeding season (Parker, 1972), and was a time they might be expected to be found in pairs. A total of 1,341 pieces of potential cover was turned, and the number and sex of geckos found were recorded. All pieces of cover included in this analysis were <3 m in length, and geckos were always found within 0.5 m of each other when two were found under the same piece of cover. The resulting data were tested for indications of aggregation using the same formula used by Cooper et al. (1985).

Statistical analysis of shelter-use data indicated that geckos do aggregate with conspecifics. Single geckos were found less frequently, and paired geckos more frequently, than predicted under a random distribution ($G = 5.97$, $P < 0.05$): the numbers of pieces of cover with 0, 1, and 2 geckos were 1,298, 35, and 8, respectively, and the cor-

responding numbers expected from the Poisson distribution were 1,291, 58, and 1. Of the eight cases of pairing, four involved two females, two involved a male and a female, and two involved two males; thus, there was no indication that these pairs were primarily involved with courting and mating behavior.

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OBSERVATIONS ON MOUNTAIN PLOVER (*CHARADRIUS MONTANUS*) BREEDING IN UTAH

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Breeding of mountain plovers has not been documented in Utah, although one adult and a nest were photographed approximately 20 miles (32 km) SSE of Myton, Duchesne County in 1978 (S. Madsen, Bureau of Land Management, pers. comm.). In the past decade, breeding has been reported only for Colorado, Montana, New Mexico, Oklahoma, Wyoming, and Canada (Leachman and Osmundson, 1990; F. Knopf, National Biological Survey, pers. comm.). This report expands the known breeding range of mountain plovers into Utah.

Reported in Utah as early as 1915 (Hayward et al., 1976), mountain plovers have been consid-

ered rare transients or casual migrants (Sparks, 1981; Behle et al., 1985). They have been recorded as summer residents in northeastern Utah (Walters and Sorensen, 1983; Cook, 1984), where breeding has been suspected (White et al., 1983). Mountain plovers breed or likely breed in adjacent areas of Wyoming and Colorado (Leachman and Osmundson, 1990).

The author and others observed mountain plovers among the Pariette Bench oil and gas producing fields, approximately 13 km south of Myton, incidental to other wildlife studies. Observations frequently spanned several hours and were conducted as frequently as other obligations

allowed. Numbers reported here represent minimum estimates obtained by cross-referencing multiple observations.

Pariette Bench has a highly varied topography of sand/gravel washes, dry upland benches dominated by low-growing shrubs of *Artemisia* sp. and *Chrysothamnus* sp., rocky cliffs, and outcroppings. Greasewood (*Sarcobatus vermiculatus*) predominates in ravines and low-lying areas. Indian rice grass (*Oryzopsis hymenoides*), galleta (*Hilaria jamesii*) and blue gramma (*Bouteloua gracilis*) are common understory grasses. There are numerous forbs in the understory, but seldom are any dominant (Goodrich and Neese, 1986). Elevations vary from approximately 1,524 m to 1,920 m. Climate is similar to that of the Great Basin.

Mountain plovers were first reported on 28 April 1993 by an oil-field worker who had seen two plovers regularly for several weeks. A nest (Nest 1) containing three eggs was discovered at the same site on 10 May in a slightly sloped, scarified area approximately 60 m from a producing well. Another three-egg nest (Nest 2) was located the same day in a flat area of sparse grasses 14 km to the ESE at a location where three plovers had been observed the previous summer (Utah Division of Wildlife Resources, pers. comm.). Nest 2 was in a large, flat area of sparse, low-growing grasses 12 m from an unimproved dirt road. A third nest (Nest 3), also containing three eggs, was subsequently located on 26 May in moderately dense black sagebrush (*Artemisia nova*) approximately 320 m E of Nest 1.

Broods were observed near all three nest sites. Three downy chicks and an adult were located at Nest 1 on the evening of 2 June. An adult had been seen on the nest on the morning of 1 June, suggesting that the eggs hatched that day. Nest 2 hatched between 18 May, when incubation behavior was last observed, and 24 May, when a brood of three young was observed. Broods were observed in the vicinity of Nest 3, but none could definitely be associated with this nest. An adult was seen on Nest 3 the morning of 1 June, but the nest was empty on 8 June. The latest estimated hatch date for all known broods, based on the estimated age of a brood observed on 23 July, was 3 July.

Nineteen plovers (five adults, nine chicks, five of undetermined age), including four separate broods, were observed in a 130 ha area around Nests 1 and 3 (Area 1). A brood of two young, with an adult, was observed on 7 July and 9 July

at a site (Area 2) 4 km NW of Area 1, where one adult had been seen on 20 May. Three broods of one, one and two young, each attended by an adult, were located near a catchment pond 11 km E of Area 1 (Area 3) between 9 July and 11 July. The brood from Nest 2 was seen only twice (Area 4) and its fate is unknown. Due to the proximity of Areas 3 and 4 (2.5 km), it is possible that this brood was one of those observed in Area 3 in July. Two additional plovers of undetermined age were sighted 3 km NE of Area 3 on 24 July. Assuming the brood from Nest 2 was observed in Area 3, a total of 31 plovers were observed in 1993: 9 adults, 15 chicks in 8 broods, and 7 of undetermined age.

Broods primarily used moderately dense, low-growing (<30 cm) shrub complexes with open understory, which differs from the open, short-grass habitat most researchers describe (Leachman and Osmundson, 1990). Plovers also were seen on and around the many well pads and dirt access roads in the area on numerous occasions and did not appear to be affected by their presence.

Arrival dates for breeding adults are uncertain, but birds were present in early April. A probable breeding chronology for Nest 2, the first to hatch, would be arrival about 11 April, nest initiation on 18 April, onset of incubation 23 April, and egg hatch on 21 May: assuming a 29-day incubation period, an egg-laying period of 1.5 days per egg, and 7 days for courtship/nest initiation (Leachman and Osmundson, 1990). Plovers were last seen on Pariette Bench in Area 1 on 26 July, when a group of 10 was observed. No plovers were found during subsequent searches on 9 August and 17 August.

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MORPHOMETRIC COMPARISON OF PUPFISH POPULATIONS, *CYPRINODON NEVADENSIS*, AT SHOSHONE AND TECOPA, CALIFORNIA

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The Shoshone pupfish, *Cyprinodon nevadensis shoshone*, occurred throughout the outflow of Shoshone Spring, Inyo County, California until the 1960s. R. R. Miller (in litt.) considered the subspecies probably extinct in November 1969. It was rediscovered in 1986 from the outflow of Shoshone Spring by Taylor et al. (1988).

Shoshone Spring is at the northern-most head of the pluvial Amargosa River in the Death Valley system. It is tributary to the Amargosa River approximately 21 km N (upstream) of Tecopa, Inyo Co., California. The elevation of Shoshone Spring is 518 m, dropping to approximately 487 m at the outflow creek. Elevation of Tecopa Bore is approximately 390 m, an elevational drop of approximately 128 m. The elevation of the Amargosa River decreases significantly as it enters and flows through the Amargosa Canyon south of Tecopa. During periods of heavy rainfall and flash flooding, the area may briefly have fast-moving water flowing downstream throughout the entire system. During his 1939 visit to Shoshone and Tecopa, Miller (1948) found no water in the Amargosa River at Shoshone and found two permanent flows occurring in the lower Amargosa River. One began shortly above Tecopa and continued through the Amargosa Canyon about 11 km to Sperry. The other flow was round in Death Valley, northwest of Saratoga Springs and approximately 32 km downstream from Sperry. Taylor et al. (1988) found water in

the Amargosa River at Shoshone, although approximately 11 km of the 21 km of streambed between Shoshone and tecopa were dry.

In a meristic analysis, Taylor et al. (1988) concluded that the rediscovered population at Shoshone most closely resembled *C. n. shoshone* as described by Miller (1948). The Shoshone population resembled *C. n. shoshone* and differed from the Tecopa population by having lower mean numbers of pelvic, dorsal, and caudal fin rays (Taylor et al., 1988). In this paper we present a morphometric analysis as a supplement to the meristic data reported by Taylor et al. (1988) for *C. n. shoshone*. We compare the results with similar data for *C. n. amargosae* from Tecopa Bore. We also compare our results for the two subspecies with those presented by Miller (1948).

Sixty specimens from both Shoshone and Tecopa Bore were collected with seines, traps, and dipnets on 31 July 1986 (Taylor et al., 1988). All specimens were cataloged (catalog numbers F-1957; F-1959) at the Marjorie Barrick Museum of Natural History, University of Nevada, Las Vegas. Following Miller (1948), each specimen was characterized for head width, body width, caudal peduncle length, depressed dorsal fin length, depressed anal fin length, pelvic-fin length, and snout length.

The Shoshone population differed from the Tecopa population by having smaller means for head width, body width, and pelvic fin length in